Vol. 14 No. 9 MAY 4, 1946

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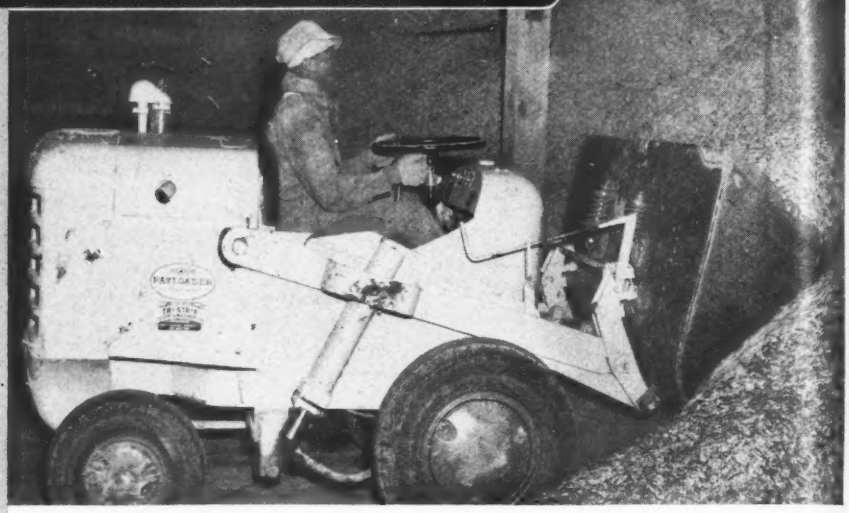

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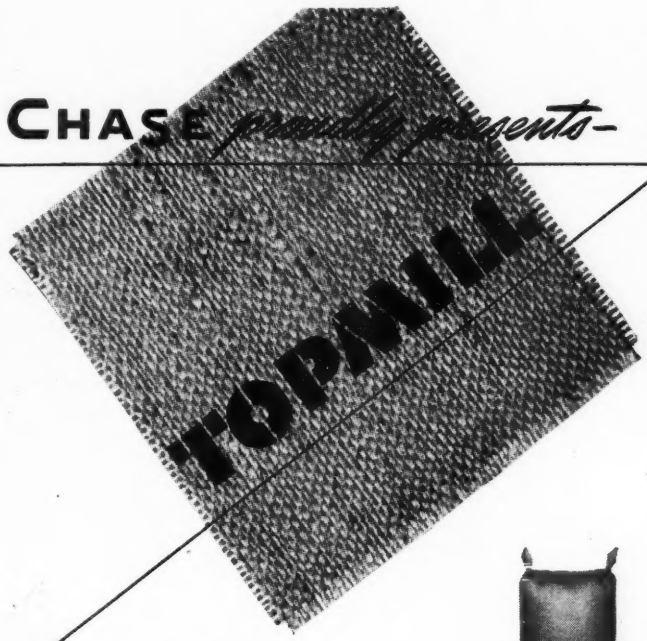

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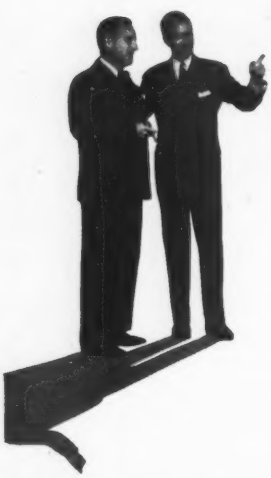

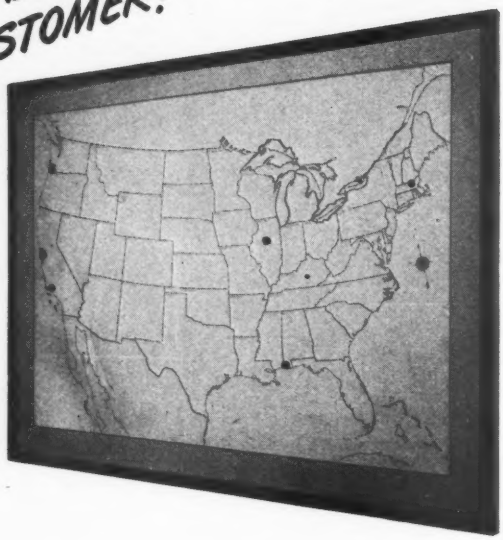

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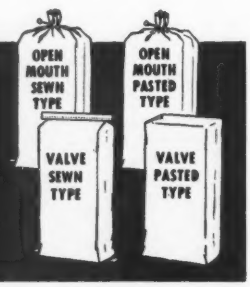

The American FERTILIZER

Vol. 104 MAY 4, 1946 No. 9

The Plant Food Content of Fertilizers

By WILLIAM H. ROSS

Consultant, The National Fertilizer Association

FIELD crops derive their nutrients from the air that surrounds them and the soil on which they grow. The air is surprisingly uniform in all parts of the world but the composition of soils with respect to their supply of available plant nutrients varies greatly in different localities. Some soils are naturally fertile and are capable of maintaining a high level of productivity over long periods of time, provided the practices employed in growing the crop, the quality of seed used and the control of insects and diseases are satisfactory. Other soils have been formed under conditions that result in an inadequate supply of the essential nutrients required by plants. The productivity of such soils will therefore be low irrespective of the conditions under which they are cultivated. To bring about a marked increase in the productivity of such soils it is necessary to add to the soil an ample supply of the plant nutrients in which it is deficient. Plant nutrient materials of this kind when artificially prepared are called commercial fertilizers.

Essential Fertilizer Elements

All field crops require varying amounts of the same plant nutrients but the manner in which they are utilized by the plant is not readily understood. It is known, however, hat, with the exception of oxygen, none of the higher plants are able to utilize directly as such any of the chemical elements that exist in nature. Some of these elements such as carbon and nitrogen are entirely inactive insofar as plant growth is concerned. Others such as phosphorus and potassium are so active chemically that they ignite spontaneously when exposed to the air. They can therefore not be used as fertilizers in the elemental state. All of the common elements, however are capable of entering into combination with other elements to form compounds that bear no resemblance to the elements of which they are composed. Thus, potassium and chlorine would be highly injurious to plants if applied as such to the soil, but potassium chloride, a compound of these elements, is one of the most valued of fertilizer materials. Other compounds of potassium are also effective in promoting crop growth but chlorine is not considered to be directly beneficial to plants in any of its compounds. Potassium is therefore spoken of as a fertilizer or plant food element while elements such as chlorine are not so considered.

Although 92 or more elements exist in nature, compounds of only fourteen of these elements are known to be essential to the growth of crops. Two of these elements, hydrogen and oxygen, are taken up by plants in the form of water. A third element, carbon with an additional supply of oxygen, is absorbed by plants through their leaves from the carbon dioxide in the air. The remaining eleven elements are taken up from the soil in various combinations by the roots of plants. In order to be of value in the nutrition of crops, these eleven elements must not only be of such a nature that they can be utilized by the plant but must also be free from all

constituents that are harmful to plant life. While there are a considerable number of fertilizer materials that comply with these specifications, the actual number is very small compared with the thousands upon thousands of materials that exist in nature, or have been prepared synthetically. The relatively small number of elements that are essential for the growth of crops may be considered as the most indispensable of all the elements. Without the materials that they form, no plants could be grown and without plants there could be no animals including man.

The eleven fertilizer elements are usually grouped into three classes. The first group consisting of nitrogen, phosphorus and potassium, or as they are more commonly referred to, nitrogen, phosphoric acid (P_2O_5), and potash (K_2O), are contained in the materials that are most often beneficial in promoting crop growth. They are therefore called the primary fertilizer elements. The second group, including calcium, magnesium and sulphur, are spoken of as the secondary fertilizer elements. The third group, known as the minor elements, consist of manganese, iron, boron, copper and zinc.

Primary Fertilizer Elements

Examples of materials that contain one each of the three primary elements, nitrogen, phosphorus and potassium, are ammonium sulphate, superphosphate and potassium chloride, respectively. A mixture composed of 400 pound of the first mentioned material, 1200 pound of the second, and 400 pound of the third would have a total weight of 1 ton of 2000 pound. A mixture of this kind could then be said to contain 20 per cent of ammonium sulphate, 60 per cent of superphosphate, and 20 per cent of potassium chloride, or a total of 100 per cent of all three materials. If mixed fertilizers contained only one material for each of the primary fertilizer elements, and if all were used in the pure state, this would be a satisfactory method for expressing the composition of a mixed fertilizer. However, fertilizer materials are never used in the pure state and mixed fertilizers are now commonly prepared from materials that may contain more than one primary fertilizer element or different proportions of these elements. A statement as to the components of a mixed fertilizer would therefore not give a true indication of its commercial value unless additional information were supplied as to its purity and composition. The practice was therefore adopted in the early history of the fertilizer industry of expressing the value of fertilizer materials and mixtures on the basis of their content of the primary fertilizer elements or some simple compound of these elements rather than on the weight of the material as a whole. Thus the value of ammonium sulphate is expressed on the the basis of its nitrogen (N) content, of superphosphate on the basis of its phosphoric acid (P_2O_5) content, and of potassium chloride on the basis of its potash (K_2O) content. It perhaps might have been preferable if the value of phosphorus and potassium materials had been based on their contents of phosphorus (P) and potassium (K) rather than of phosphoric acid (P_2O_5) and potash (K_2O) but to make the change now would lead to much confusion and misunderstanding. It is because of this same difficulty that the metric system of expressing weights and measures has not yet replaced the English system in this country although the former is generally recognized to be the superior system.

If ammonium sulphate, superphosphate and potassium chloride be assumed to contain 20 per cent of nitrogen(N), 20 per cent of phosphoric acid (P_2O_5) and 60 per cent of potash (K_2O), respectively, the mixture referred to above as containing 100 per cent of these fertilizer materials will contain only 4 per cent of nitrogen (N), 12 per cent of phosphoric acid (P_2O_5) and 12 per cent of potash (K_2O), or a total of 28 per cent of all three constituents. Such a mixture is designated as a 4-12-12 mixture. The expression 4-12-12 is also spoken of as the grade or guaranteed analysis of the mixture.

The available N, P_2O_5 and K_2O in a fertilizer have long been referred to as plant foods. Strictly speaking these constitutents of a fertilizer are not plant foods but simply the units which go to build up the foods utilized by plants. The correctness of an expression is determined by its period of usage. The term *plant food* as applied to the N, P_2O_5 and K_2O in a fertilizer has been used throughout the entire history of the fertilizer industry, and has been adopted in the wording of the fertilizer control laws of the various states. The term *plant food* can therefore be correctly considered as having two meanings: (1) the complex carbohydrates and proteids constructed within the bodies of green plants; and (2) the primary constituents, N, P_2O_5 and K_2O in a fertilizer. As used in the fertilizer industry and in the fertilizer control laws of the United States, the second meaning only is applied to the term *plant food.*

Secondary and Minor Elements

At the time that fertilizers were first placed on the market, the value of a fertilizer was considered to depend on its content of the plant-food elements only. While these elements may suffice for many soils, other soils in different sections of the country may require treatment with fertilizers containing one or more of the secondary or minor elements in addition to the so-called plant-food elements. The secondary elements, calcium, magnesium and sulphur, are required by many plants in amounts that approximate their requirements for the plant-food elements. If they are not already in the soil in sufficient concentration, more must be added in the form of fertilizers for best results.

The minor elements are so-called because they are required by plants in relatively small quantities. Many of the low analysis materials that were formerly so widely used as fertilizers contained ample quantities of the secondary and minor elements to meet plant requirements. The synthetic high analysis fertilizer materials, on the other hand, are lacking as a rule in the secondary and minor elements and such fertilizers must therefore be supplemented by suitable additions of compounds of these elements if best results are to be obtained on soils deficient in these elements.

The essential fertilizer elements are sometimes referred to as plant nutrients. They are plant nutrients and the secondary and minor elements can very properly be referred to in this way. However, it would give rise to confusion in the fertilizer industry if the primary fertilizer constituents, N, P_2O_5 and K_2O, were referred to as plant nutrients. The 4-12-12 mixed fertilizer described above was stated to contain 28 per cent of total plant food. It would be a mistake to state that this mixture contained 28 per cent of plant nutrients for the reason that it contains calcium, and sulphur, as well as nitrogen, phosphoric acid (P_2O_5) and potash (K_2O). Its content of plant nutrients would therefore be in excess of 28 per cent.

Variation in Plant Food Content of Fertilizers

The fertilizer elements as already explained must be combined with other elements to be of value in promoting crop growth. Inasmuch as these combinations differ greatly in composition, their content of plant food may likewise cover a relatively wide range. Thus the nitrogen in sodium nitrate amounts to 16.5 per cent, In ammonium sulphate to 20.5 per cent, and in urea to 46.5 per cent. None of these materials contains any appreciable quantity of impurities and their nitrogen or plant-food content can therefore not be significantly increased without completely destroying the materials and their value as fertilizers.

In the early history of the fertilizer industry, the principal source of the materials used as fertilizers were mineral deposits and industrial by-products. The materials produced from these sources all contained a low percentage of plant food and the mixed fertilizers prepared from them were necessarily low analysis also. As late as 1910 the total plant food in the average mixed fertilizer amounted to only 15 per cent. At that time no economical methods were known for the production of high analysis materials. Within the past 20 years new methods have been developed for fixing the nitrogen of the air in the form of such high analysis materials as ammonia, urea and ammonium nitrate. In recent years the fertilizer industry has also made remarkable progress in the enrichment of fertilizer salts by the elimination of impurities that are not considered essential to crop growth. Thus the common salt that is found admixed with potassium chloride in its mineral deposits may be considered as an impurity without fertilizer value. Inasmuch as the salt is present in the form of a mixture rather than in chemical conbination, it can be removed from the potassium chloride by suitable means. In this way the potash (K_2O) content of the crude product has been increased from a minimum of about 22 per cent to a maximum of about 63 per cent. No further increase in the plant-food content of the material is possible.

The fertilizer material most commonly used as a source of phosphoric acid (P_2O_5) is superphosphate. The statement has been made that this material contains only 20 per cent of plant food and 80 per cent of inert material. It is true that it contains only 20 per cent of total plant food, but the plant food is expressed as P_2O_5 which, like the fertilizer elements, must be in combination with other elements to be available to plants. The plant-food content of superphosphate, amounting to 20 per cent of the material, would thus be of no value whatever to plants unless combined with a part at least of the 80 per cent portion. This portion also con-

(Continued on page 28)

Industry Advisory Committee Discusses Future Problems

The Fertilizer Industry Advisory Committee of the U. S. Department of Agriculture met in Washington, April 18th, in response to a call issued by L. B. Taylor, U. S. D. A., vice-chairman of the committee. W. A. Minor, U. S. D. A., presided. Also present were H. M. Albright, H. B. Baylor (for Franklin Farley), A. H. Carpenter (for J. E. Sanford), George Cushman, J. F. Doetsch, R. B. Dougla. George W. Gage, John A. Miller, Kenneth Morrison (for C. F. Hockley), W. S. Rupp, F. T. Techter, Nelson T. White, members of the committee; Richard Bradfield, R. W. Cummings, M. H. Lockwood, F. S. Lodge, C. A. Woodrum, Robert E. Yoder, by invitation; J. C. Bagwell, Roland Crumpler, W. G. Finn, F. W. Parker, L. G. Porter, Albert C. Howard, L. B. Taylor, W. F. Watkins, U. S. D. A.; J. W. Wizeman, CPA; C. G. Gran, OPA. Mr. Minor opened the meeting by expressing the appreciation of the Department to the committee for their work during the war and for their willingness to continue their advisory work now that the war is over.

Status of Committee

The Solicitor's office reported that information had been sought from the Attorney General's office as the legal status of advisory committees continuing to function after the war. The Attorney General had replied to the effect that if the committee is advisory only, is representative of the industry and does not promulgate or administer policies, its consultation with U. S. D. A. so limited does not violate the antitrust laws.

World Fertilizer Situation

The Office of Requirements and Allocation, in discussing the world picture of fertilizer supplies, announced that while the Raw Materials Board had been terminated, the Board was continuing and had been enlarged to include, in addition to representatives from the three original countries, Canada, United Kingdom, and the United States, representatives from Belgium, Chile, Denmark, France, Netherlands and Norway. Distribution of world supplies of fertilizer materials will be as equitable as can be agreed within the committee. World shortages will continue through 1946. It is now estimated that there will be an over-all shortage of 10 per cent in nitrogen. Even with the increase of phosphate rock production in North Africa and possible production from Pacific Islands, there will be a 2,000,000 ton shortage next year. Potash, while currently acute, could become the easiest situation. We can expect no potash from Germany this year. The bulk of exportable German production comes from territory now in the Russian zone. All the potash that is produced in the American and British zones can be utilized in local consumption. Europe will have about 50 per cent of its potash requirements this year. Spanish production above local needs is going to England and continental Europe.

Fertilizer Requirements, 1946–47

The Materials and Equipment Branch presented the 1946–1947 fertilizer requirements program for the United States as it now appears—800,000 tons of nitrogen, 1,850,000 tons of phosphoric acid (P_2O_5), and 800,000 tons of potash (K_2O)—saying that it was realized that the nitrogen and potash production programs micht each fall 100,000 tons short of requirements but that the phosphoric acid outlook was better.

AAA Program

AAA discussed its soil conservation program, saying that in the calendar year of 1945 the program used 1,040,000 tons of normal superphosphate, 418,000 tons of which were distributed in the "Purchase Order Plan" and 622,000 tons from contract purchases. During the first 3 months of 1946, only 71,000 tons of superphosphate have been obtained.

Supplies of Fertilizer Materials

The Civilian Production Administration announced that in response to the recommendation of the Potash Producers Industry Advisory Committee initial steps were being taken to place all potash materials under allocation pending final decision with July 1st as a possible effective date. A somewhat short supply, export demands, and areas of local pressure were given as reasons for the recommendation. For the 1945–46 program a total of 700,000 tons of N seemed in sight. Loss of production because of strikes, which however is somewhat offset by increases in production of other materials and by exports, reduced this figure to 689,000 tons of N. As of March 30 about 572,000 tons had been

delivered. Production of sulphate of ammonia had been severely adversely affected by the steel strike and was now feeling the effects of the coals strike. Imports of sulphate of ammonia, ammonium nitrate, cyanamid, and ammonium phosphates from Canada were on or ahead of schedule. Ammonia solutions were being received on schedule in considerably greater tonnages than ever before. Imported and domestic nitrate of soda are expected to be a little under their scheduled volume. Total exports of nitrogen allocated from the United States amount to approximately 73,000 tons, mostly in the form of Government-produced ammonium nitrate. Production of superphosphate of all grades for the first 8 months of the fiscal year amounted to an equivalent of 1,020,000 tons P_2O_5. If continued at the same rate, production for the year will be 1,530,000 tons P_2O_5, equivalent to 8,500,000 tons superphosphate 18 per cent P_2O_5. Total potash production in 1945–46 is estimated at 892,000 tons K_2O, with an increase of 11,000 tons K_2O scheduled for 1946–47. The chemical industry needs about 100,000 tons K_2O and about 65,000 tons go for export to other American countries, leaving for domestic agriculture this year about 727,000 tons K_2O.

Secretary of Agriculture Anderson addressed the committee in the afternoon, expressing his personal appreciation of the importance of fertilizers in the world food shortage emergency. He discussed the world-wide conditions and the requests from all theatres for fertilizer assistance.

Among the suggestions made by committee members to the Department for consideration were (1) that the Secretary issue a statement on the effect of the coal strike on food production as a much longer continuation of the strike would mean not only closing down of by-product sulphate of ammonia production but the closing of most of the synthetic nitrogen plants as well. (2) It was recommended that the Government should arrange to continue operation of government-owned sulphuric acid plants in the South in order to insure superphosphate production, and (3) that the Government should provide a price solution for the problem. The committee also recommended (4) that the Army or some other Government agency utilize government-owned sulphuric acid plants and stand-by nitrogen fixation plants to produce sulphate of ammonia for use in occupied zones, particularly in China and Japan, as well as for other uses. (5) The committee by a vote of 11 to 2 indicated its opinion that allocation of potash should be unde taken.

Materials Ceilings Raised for Emergency Shipments

Due to the expanded food production program, the demand for fertilizer raw materials for use in mixed fertilizers and for distribution as such, results at times in creating severe local shortages, which are intensified by the discontinuance of allocations and manufacturing difficulties.

Such shortages can be relieved, at least in part and temporarily, by shipments from production points more distant than the customary points of supply and, also, in some instances by using higher-cost ingredients or methods of production.

These conditions render it impossible to secure or unfair to require immediate delivery at the maximum prices which would be applicable otherwise in the area where the shortage exists.

Emergency relief measures, to be effective, usually require price adjustment promptly upon application, to assure that essential supplies of plant food shall be available in time to satisfy the needs of growing crops.

The Office of Price Administration has therefore issued Amendment 9, effective April 17, 1946, to Revised Maximum Price Regulations 205 (fertilizer raw materials). The amendment appears as a new paragraph (d) added at the end of Section 2 and reads as follows:

"(d) Emergency relief orders. Upon certification by the Secretary of Agriculture that there exists or threatens to exist a shortage of any fertilizer raw material within any area and that this shortage may be releived by production or shipment of any fertilizer raw material under such unusual circumstances as to render it impossible to secure or unfair to require delivery at the maximum price which would otherwise be applicable, the Office of Price Administration may, upon application, except such sales from the appropriate provisions of the regulation and establish maximum prices therefor which will provide, in specific instances, for such production or shipment, requiring the seller to certify on the invoice the unusual circumstances under which the goods were produced or shipped and that the sale is in accord with the provisions of the applicable order.

"Such application shall be filed with the Cereals, Feeds and Agricultural Chemicals Branch of the Office of Price Administration in Washington, D. C."

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Philadelphia 18
Superphosphate Production for 1945 26

An Effective Fertilizer Committee

The United States Department of Agriculture has expressed its appreciation of the services rendered by the Fertilizer Advisory Committee during the war and its appreciation of the willingness of the committee to continue its services.

Before the offer of the committee to continue its services was made, it was considered advisable to have its legal status defined. To this end a ruling was sought from the United States Attorney General. His response was in effect that if the committee is advisory only, is representative of the industry, and does not promulgate or administer policies, its consultation with the United States Department of Agriculture, so limited, does not violate the anti-trust laws.

An instance of the advisability of continuing the advisory committee is provided by the new Revised Maximum Price Regulation 205 under which, where a shortage exists or is imminent in any area, it may be relieved by proposed movements or use of high-cost materials or processing without jeopardizing essential supplies of the materials in other areas. In this the producer is naturally in position to advise and suggest solutions under which manufacturers could most efficiently cooperate.

Then, too, so long as the Office of Price Administration is empowered to fix prices of fertilizers, of course, the fertilizer manufacturer should be heard, and the advisory committee can serve as his spokesman.

Fertilizers needed in rehabilitating agriculture of foreign nations will involve the use of both raw and manufactured fertilizer materials of this country. How much the fertilizer industry of this country can contribute, is a matter about which the advisory committee can provide dependable information.

In these, and doubtless many other matters that may arise affecting the manufacture and distribution of fertilizers, in which the programs of the United States Department of Agriculture are concerned, there seems to be no reason why the advisory committee cannot promote the fullest possible cooperation. In so doing the best interests of agriculture can be served.

N. F. A. Warns of Fertilizer Shortage

Supplies for fertilizer for American farms will be seriously reduced if the present coal strike is prolonged and if exports of fertilizer to foreign countries are increased in the coming months, The National Fertilizer Association declared recently.

Output of ammonium sulphate has already been sharply curtailed as a result of the coal strike. Prolongation of the strike will force a complete shut-down of ammonium sulphate production and will also close down most of the synthetic nitrogen fixation plants. The recent steel strike is estimated to have cut production of ammonium sulphate by 124,000 tons.

Increased foreign shipments, the NFA said, would add to the industry's continued difficulties in securing materials, transportation and labor for meeting domestic requirements.

The committee on Fertilizers of the Combined Food Board revealed recently that 73,472 tons of nitrogen have already been allocated to foreign countries. This would be equivalent to 358,400 tons of sulphate of ammonia. It has been reported that 10,000 tons of sulphate of ammonia have been allocated for China.

No announcement has been made of the responsibility for increased foreign shipments of fertilizers that the United States, major producer of commercial fertilizers, may be called to assume. However, on March 26th the Committee on Fertilizers of the Combined Food Board indicated that to meet urgent food requirements in the American and British zones of Germany, agreement has been reached for the shipment of soluble phosphate from Belgium for use during this crop year. At the same time it was reported that additional shipments of ammonium sulphate will be made to India. The fertilizer manufacturers stated, however, that they were not speaking in opposition to the present foreign commitments of the Government which are a comparatively small percentage of domestic production. They sought only to explain to the public at large and to the farmer in particular the effects of such shipments and of the strikes on the quantities of fertilizers available to domestic users.

Despite wartime handicaps to fertilizer production, American farmers last year were able to use 76 per cent more fertilizer than in the average of the five-year period 1935–1939. In 1945, production reached an all-time record peak of about 13,000,000 tons. If present difficulties continue, the NFS stated, some farmers may be unable to get all the grades and quantities of fertilizer they may demand in 1946, despite ample production facilities.

Chase Bag Company Wins Honors for Accident Prevention

In recognition of over a half-million man hours of plant operation without a lost-time accident, A. J. Rogers, Plant Superintendent, received a plaque from the Liberty Mutual Insurance Company at a recent ceremony held in the Goshen, Indiana, plant of the Chase Bag Company. At the same time, R. J. Sorensen, Director of Labor Relations, presented the Chase Bag Company Safety Flag for 1945 to J. D. Cramer, Branch Manager.

The record accomplished in this Chase plant during the past year illustrates the results of the cooperative effort of the Chase Bag Company management, the employees, and the safety engineering service of the Liberty Mutual Insurance Company.

Spring Grass Shows Higher Phosphorus Content

Spring samples of pasture grass in Texas showed greater relative increase in phosphoric acid content, due to the fertilizer used, than did those collected in the fall, and Bermuda grass showed greater increases than Dallis, carpet and buffalo grasses. Application of approximately 100 pounds P_2O_5 caused such an increase in phosphoric acid content of Bermuda grass that only one-fifth of the phosphated grass samples were deficient for range animals as compared with three-fifths of the phosphated carpet grass samples. The application of phosphate caused a relative increase in concentration of phosphoric acid of from 50 to 100 per cent in about one-fourth of the samples of grass at young and intermediate stages of growth, but did not have this great an effect on any of the samples at the bloom or mature stages. About one-fourth of the samples at all stages of growth showed a relative increase in percentage of phosphoric acid of from 25 to 50 per cent, according to Dr. J. F. Fudge and R. R. Lancaster, Texas, Progress Report 996 of March 23rd.

More Evidence that Sodium is a Plant Food*

By FIRMAN E. BEAR

New Jersey Agricultural Experiment Station

If any further evidence is needed to show that the "soda" of nitrate of soda has value as a plant nutrient, it can be found in the October, 1945, issue of the Journal of the American Society of Agronomy, in a very interesting paper from the Alabama Experiment Station on the subject: "Sodium as a Plant Nutrient and Substitute for Potassium." The conclusion reached by the authors, M. E. Holt and N. J. Volk, was that "the substitution of other forms of nitrogen in place of sodium nitrate as a source of nitrogen for sandy soils, may in time necessitate the addition of sodium in some form to obtain maximum yields of crops." That seems to say that sodium is an essential element.

This is not the first scientific paper dealing with sodium, for this element has been a matter of interest to soil scientists for many years. Way back in the early 1900's, Dr. B. L. Hartwell and his associates at the Rhode Island Experiment Station began their famous comparisons of sodium and potassium salts, and they finally reached the conclusion that sodium could serve as a partial substitute for potassium in plants. In other words, when soils lacked potassium, sodium could come to the rescue, providing the potassium deficiency were not too serious.

Other Investigations

Since that time, many experiment station men have investigated various phases of this problem. Among them was Paul M. Harmer of Michigan, whose recent review of the subject was published in the August, 1945, issue of *Soil Science*. In his concluding remarks, Harmer says: "All crops investigated may be placed in one of two classes, each of which may be subdivided into two tentative groups with regard to their response to sodium:

A. Benefited by sodium in deficiency of potassium.
   - Group 1. None to very slight benefit: buckwheat, corn, lettuce, onion, parsley, parsnip, peppermint, potato, rye, soybean, spinach, squash, strawberry, sunflower, and white bean.
   - Group 2. Slight to medium benefit: asparagus, barley, broccoli, Brussels sprout, caraway, carrot, chicory, cotton, flax, millet, oat, pea, rutabaga, tomato, vetch, and wheat.

B. Benefited by sodium in sufficiency of potassium.
   - Group 3. Slight to medium benefit: cabbage, celeriac, horse-radish, kale, kohlrabi, mustard, radish, and rape.
   - Group 4. Large benefit: celery, mangel, sugar beet, Swiss chard, table beet, turnip.

Commenting further, he writes: "Sodium appears to have definite functions which it can best fulfill in those crops which are benefited (by sodium) in the presence of ample potash. This is evident in (a) improved vigor of plant and color of foliage which continues for a longer growing period, (b) increased disease resistance, and (c) decreasing wilting in hot, dry weather."

Farmers First to Find Value

Farmers had known for a long time that nitrate of soda, by and large, was the most effective carrier of nitrogen on the market. Even when used on sandy soils, from which it was said to be so easily leached by rains, it

(Continued on page 30)

*Reprinted from "Victory Farm Forum," March, 1946, published by Chilean Nitrate Educational Bureau.

BRADLEY & BAKER

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FERTILIZER MATERIALS MARKET

NEW YORK

Shipments Continue at Record Levels with Material Supplies Coming from Current Production Only. Steel Strike Cut Sulphate of Ammonia Output by Almost Half. Organic Material Ceilings Prevent Imports. Phosphate Rock Situation Remains Tight

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, April 29. 1946.

As the end of the most active mixing season in the history of the fertilizer industry approaches, demand from farmers continues at the record-high level and both mixed goods and raw materials are being shipped against current production. Lack of inventories eliminates the possibility of supplying new domestic demand and increasingly heavy export inquiry.

In view of the fact that world shortages will continue through 1946, the Fertilizer Committee of the Allied Combined Food Board will function throughout the year and allocate supplies of fertilizer materials so that available supplies can be distributed as equitably as possible. It is estimated that the over-all shortage of nitrogen will be ten per cent, phosphate rock will fall short of world needs by two million tons, and production of potash salts will not be able to meet world requirements.

Sales of fertilizer tax tags for the first quarter of this year indicate that total consumption for the current fertilizer year will be larger than any preceding like period.

Sulphate of Ammonia

Production for the first two months of this year was approximately 45% lower than for of the recent steel strike. The present strike of coal miners will tend to further reduce the production of by-product material, and relief in this market cannot be expected in time to affect appreciably this mixing season. Imports of ammonium sulphate from Canada have been up to or ahead of schedule to date. The supply situation on ammonia solutions has eased somewhat, but shipments are only being made against previous contracts.

Nitrate of Soda

In this area, at least, arrivals of Chilean material have been ample to fulfill regular contracts, but additional demand remains unsatisfied. It is reported that domestic production is now on a higher level, and no critical shortage in this market is in view for this year.

Organic Materials

With continuing lack of imports, and further curtailment of domestic output in the packing industry, this market has become even tighter, if possible. The retention of present ceiling prices makes it impossible for importers to compete agains foreign buyers, notably Great Britain.

Superphosphate

Both export and domestic demand continues abnormally high, and production is limited to the available supplies of phosphate rock. Production ior February was approximately 630,000 tons of 18% material, the largest tonnage ever reported for any corresponding periodl Output of concentrated superphosphate for February was placed at 25,000 tons.

Phosphate Rock

Supply position remains exceedingly tight with production at maximum levels and constant pressure from current contractors to increase teeir commitments. Heavy export inquiry remains unfilled to date. Production of Nerth African rock is estimated to be at 39% of the average pre-war figure, and the recent arrival of a small cargo of this material in New York is to be noted.

Potash

It is officially estimated that about 727,000 tons K_2O will be available for domestic agriculture for 1946–47, and total production will amount to around 900,000 tons K_2O. In line with the recommendation for the

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Potash producers' Industry Advisory Committee, initial steps have been taken to place all potash materials under allocation again with July 1st as a possible effective date. Final decision in this matter is pending further conference with government officials. In view of the fact that European production can at present supply only 50% of the needs in that area it is not expected that foreign potash will be able to move into this market before the end of 1946. All domestic producers are shipping material as soon as processed, and with a lack of available stocks no easing of this market can be foreseen in the near future.

CHARLESTON

Manufacturers Worrying About Next Season's Materials, Particularly Organics. No Surplus in Any Material for Present Season's Output.

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, April 30, 1946.

The production of all fertilizer materials is short of demand and many observers are concerned about the scarcity, particularly of organics, for the next season. The Southeast requires organics particularly and the fertilizer market continues to lose organics to feed market.

Organics.—Supplies still remain acutely tight and demand strong, as buyers are anxious to get in supplies even if not to be used this season. Low OPA ceilings still prohibit importations of practically all fertilizer organics. A small amount of adulterated cottonseed meal has come in from abroad.

Castor Pomaçce.—Still nothing being offered above old contracts and even these are behind in deliveries.

Potash.—Some talk of allocation of supplies for next sason but nothing definite yet. Shipment against current contracts have been regular and demand for additional amounts is strong as manufacturers finish up this season's orders for mixed goods.

Phosphate Rock.—Producers are still shipping from current production and demand remains extremely strong. Suppliers are mainly trying to take care of old customers and new requirements for the most part are going unsupplied.

Superphosphate.—For lack of phosphate rock because of a strike in one of the rock producer's operations, several superphosphate producers have been hamstrung and superphosphate is extremely tight. Many dry mixers are having difficulty getting contracts for next seasons needs.

Sulphate of Ammonia.—Continuance of the soft coal strike has reduced output of sulphate of ammonia and shipments are about 20 per cent off. Demand still exceeds supply. Some producers have sent out contracts for next season but without prices. A hike in price is expected although it may not be the $5.00 increase previously considered.

Ammonium Nitrate.—Demand still remains strong and supply short. Conversion of several government plants to commercial production is still delayed but by end of year, at latest, commercial production should be helping ease the general nitrogen shortage.

Nitrate of Soda.—Both domestic and imported remain scarce, as the shortage of soda ash caused by the coal strike affects domestic production; and past shipping troubles have delayed importations.

Packing House Products.—The constant strong demand is far out of proportion to the supply as the feed market continues to pay higher prices than fertilizer manufacturers can pay. Production also continues below normal.

Manufacturers' Sales Agents for **DOMESTIC**

Sulphate of Ammonia

Ammonia Liquor :: Anhydrous Ammonia

HYDROCARBON PRODUCTS CO., INC.

500 Fifth Avenue, New York

CHICAGO

Criticism of Order M-390 Continues. Feed Production Curtailed by Shortage of By-Product Material

Exclusive Correspondence to "The American Fertilizer"

CHICAGO April 27, 1946.

One hears from the trade that the compromise on Order M-390 regarding chrome stock is difficult to understand. In view of the present critical food situation and that organics are so limited and so essential, the question is: Why should the C.P.A. consider glue paramount to food production?

Production of animal protein feed has been further curtailed by the slackening of live stock receipts. The demand for meat scraps, tankage, blood, and bone meal still exceeds the available supply.

Ceiling prices are:

High grade ground fertilizer tankage, $3.85 to $4.00 ($4.68 to $4.86 per unit N) and 10 cents; standard grades crushed feeding tankage, $5.53 per unit ammonia ($6.72 per unit N); blood, $5.53 ($6.72 per unit N)· dry rendered tankage, $1.25 per unit of protein, f.o.b. producing points.

PHILADELPHIA

No Improvement in Tight Fertilizer Situation. Coal Strike Cuts Sulphate of Ammonia Production. Allocation of Potash Expected.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, April 29, 1946.

There has been no improvement in the fertilizer situation so far as supplies are concerned. Sales of mixed goods in the first quarter of this year were considerably in excess of the previous similar period, but still not equal to the demand. Contract deliveries of practically all materials are very much in arrears. In fact, some machinery orders are said to be as much as a full year late. The production of packing-house by-products is far below normal, with considerable slaughtering suspended. However, if the production were normal, it is doubtful whether the fertilizer mixer would get much. It is expected that the world shortage of fertilizers will continue through 1946.

Sulphate of Ammonia.—Production continues on reduced scale due to coal strike and stocks are definitely short. Since this precludes advisability of shipments to Germany and Japan, it has been suggested that nitrogen producing plants of these two countries be put back into production.

Nitrate of Soda.—Supply is limited and situation continues tight.

CASE HISTORY No. 5

One in a series of factual experiences of a group of American manufacturers with Multiwall Paper Bags.

COST COMPARISON

	100 lb. Burlap Bags	100 lb. Paper Bags
Bag cost per M.....	$296.20	$117.85
Bag cost per 100 lbs....	.296	.118
Labor cost per 100 lbs...	.125	.050
Total bag and labor cost per 100 lbs.....	.421	.168
Savings per 100 lbs. paper over fabric....		.253
Savings per ton, paper over fabric.....		5.06

DETAILS OF LABOR COSTS

Burlap Bags (with paper liners)

		Production per hour	Cost per 100 lbs.
1—Man filling at .82 per hour	$.82		
1—Man weighing at .82 per hour	.82		
1—Man sewing at .89 per hour	.89		
3—Men handling at .82 per hour	2.46		
6—Men in all	$4.99	4000 lbs.	.125
Multiwall Paper Valve Bags			
1—Man filling and check-weighing at	.82		
3—Men handling at .82 per hour	2.46		
4—Men in all	$3.28	6500 lbs.	.050

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CHEMICALS	FOOD
FEEDSTUFFS	MISCELLANEOUS

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FLUFFY ✓	LIGHT
FREE-FLOWING	VISCOUS

ST. REGIS BAG PACKAGING SYSTEMS are made in a variety of capacities, speeds, and manpower requirements to suit specific products and plant layouts. Machines are available in types to meet the special characteristics of a wide range of products, with filling speeds as high as twenty-four 100-lb. bags per minute—with one operator.

HOW A ST. REGIS PACKAGING SYSTEM SAVES MONEY

for a manufacturer having limited* production

This fifth case history in a series of MULTIWALL success stories, relates the savings effected by a cocoa manufacturing concern through the introduction of St. Regis Multiwall Paper Valve Bags and Machine Packaging. Prior to the installation of the St. Regis Packaging System this company used various types of packages . . . barrels, fibre drums, and open-mouth burlap bags with paper liners. Since their initial trial, about one year ago, St. Regis Multiwall Paper Valve Bags have been found to be the most efficient and economical container for the purposes of this company.

REDUCED LABOR COSTS: Prior to adopting the St. Regis Packaging System this company was using one man to fill the bags, one to weigh them, and one to sew them closed. Now, one operator can fill and check-weigh 25 more 100-lb. bags per hour than the former three man crew . . . a labor saving of 66% in filling and weighing.

INCREASED PRODUCTION: The original three man filling crew and a three man handling crew were able to handle only 4000-lbs. of cocoa per hour. Since the installation of the St. Regis Packaging System one man is able to supply the three-man handling crew with 6500-lbs. of cocoa for shipment to customers . . . an increase in production of 62½% over the old system.

AN EXAMPLE IN PACKAGING ARITHMETIC

QUESTION:

If it took three men one hour to fill, weigh and close 4000-lbs. of cocoa . . . how can one man fill, check-weigh and close 6500-lbs. in an hour?

ANSWER:

By changing over to a St. Regis Packaging System using a St. Regis Valve Bag Packer to fill Multiwall Paper Valve Bags.

REDUCED CONTAINER COSTS: In addition to the product protection afforded by multiple walls of kraft paper and the greater ease of handling Multiwalls, the customer discovered a saving of over 55% in bag cost by using Multiwall Paper Bags instead of Burlap Bags with paper liners.

The figures in this example prove conclusively that St. Regis Packaging Systems are just as applicable to small packaging operations as they are to operations that require batteries of high-speed packers. Call in a St. Regis field representative to advise you on the type packer that will best suit your needs.

MULTIWALL

Limited production due to government quotas.

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Without obligation, please send me full details regarding "Case History" No. 5, outlined above.

NAME_____

COMPANY_____

ADDRESS_____

Castor Pomace.—There has been limited movement on contracts.

Blood, Bone, Tankage.—There is plenty of inquiry, with market bare of supplies, and very little reaching the fertilizer trade.

Phosphate Rock.—Production is heavy but all under contract, and shipments are keeping pace with production. Export demand is heavy but left very largely uncovered. It is predicted that the world shortage next year will be enormous.

Superphosphate.—Record quantities are being produced and used but still not sufficient to meet the demand. Export inquiries accordingly receive scant attention.

Potash.—Shipments are being made only on contract and no resales are on the market. There has been some movement of by-product potash, but not in sufficient quantity to ease the market position. It is expected that by the time this is printed potash will have been reluctantly put back under allocation. This is newspaper conjecture.

How Bemis Bags Are Made

To those concerned with packaging and shipping, a new booklet recently issued by Bemis Brothers Bag Company entitled "Packaging Picture—The Story of Bemis Multiwall Paper Shipping Sacks" will be of interest. This sixteen-page pamphlet is profusely illustrated, the story being told almost entirely by pictures, with very brief text.

The booklet tells how Bemis multiwall bags are made, how quality is controlled and how brands are designed. It also tells about Bemis specialists, who are available to users of multiwall bags for advice and expert assistance.

The research and testing laboratories, where new types of bags are developed and where tests on bags for packing new products are made, are also described.

Copies are available from any one of the thirty-three Bemis Brothers Bag Company offices or from the headquarters office at 408 Pine Street, St. Louis 2, Missouri.

Cattle Can Judge Pasture

Livestock are intelligent . . . they seem to prefer feed which is rich in minerals and food value. Experience of farmers throughout the state continues to support this belief.

For example, J. D. Lowe, farm unit demonstrator in Rusk County, Texas, reports that cattle most frequently are found in the fertilized areas of his pasture. He assumes that

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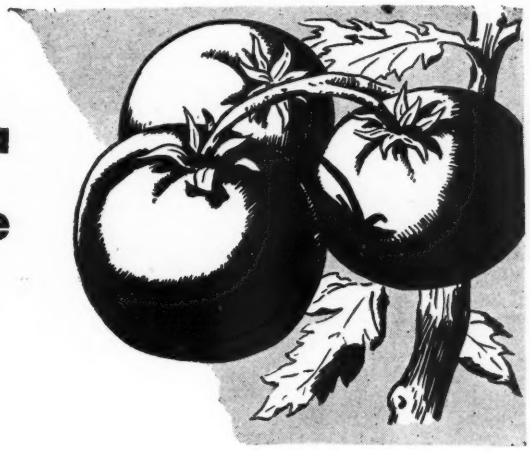
Our plant at Trona, Calif., is operating at capacity to provide supplies of these essential plant foods, and other materials needed in the national effort.

Manufacturers of Three Elephant Borax and Boric Acid

See page 27

Tomatoes have a growing appetite for nitrogen

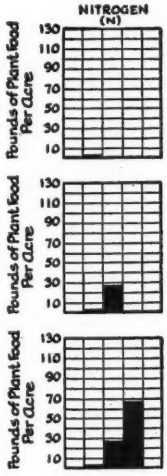


IN NEW JERSEY

During the 1st month, tomatoes absorb only about 3% of the total nitrogen they're going to need, according to New Jersey experiments.

In the 2nd month, the tomato plants begin to take hold. Still they use less than one-third of the nitrogen required for full growth.

But in the 3rd month, the tomato plants take up more than two-thirds of the nitrogen required for full growth and maturity.



Conclusion—Tomatoes need a nitrogen fertilizer that resists leaching for more than two months and then is ready to be taken up in large quantities during the last month before harvest.

Your fertilizer fits the crop when you use Urea Nitrogen

Urea nitrogen is completely available to plants, but is resistant to leaching owing to chemical reactions which take place in the soil. As a result, the nitrogen is available when required late in the growing season.

Du Pont UREA-AMMONIA LIQUORS provide an excellent source of urea nitrogen. They're low in cost, easy to handle, and produce quick-curing mixtures that store well and drill well. They also have a low acid reaction in the soil.

To meet the varying requirements of manufacturers, Du Pont supplies four UREA-AMMONIA LIQUORS and URAMON Fertilizer Compound. For additional information, write E. I. du Pont de Nemours & Co. (Inc.), Ammonia Department, Wilmington 98, Del.

NITROGEN THAT FITS THE CROP

DU PONT UREA NITROGEN { **UREA-AMMONIA LIQUORS** • **URAMON** Reg. U.S. Pat. Off. **Fertilizer Compound**

DU PONT REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

the answer is not only more grass in the fertilized areas, but a better quality of grass "that satisfies the cattle's hunger or appetite."

Here is testimony from another farmer, Ivan Dorsett of Cass County: "Three ricks of hay were left in my meadow. Two from ground that received no phosphate and one rick from land that received phosphate. Preference of the stock for phosphate was plain for anyone to see. . . . The hay from the ground that has phosphate was preferred both by cattle and work stock. We depend a great deal on grass and hay to produce cattle. If their taste is so great for grass containing more minerals and food value, are we not foolish if we fail to provide it?" he asks.

R. R. Lancaster, pasture specialist for the A. and M. College Extension Service, says a week never goes by but what some farmer comments on the value of improving pastures with fertilizer.

Muck Farmers Must Substitute Fertilizer

Muck farmers in Michigan, unable to purchase high potash content fertilizers, are advised to use the best substitute available and balance the crop feeding with a higher potash fertilizer when it becomes available. Dr. Paul M. Harmer, soils specialist at Michigan State College, made this recommendation upon receiving many requests from farmers.

Commercial concerns do not have 3–9–18 fertilizer this spring because of a potash shortage, Harmer said. The firms, however, say the supply will be adequate later in the summer.

"I recommend that they use a 2–12–6 mixture now, making application of about 500 pounds to the acre. Later when it is available, the farmer may apply 0–9–27 to his muck land crops at about 600 pounds per acre and it will balance out the application."

Wright Appointed Barrett Agronomist

E. J. Willis, Sales Manager of the Pacific Coast District, The Barrett Division, Allied Chemical and Dye Corporation, San Francisco has announced the appointment of David Norman Wright as Agronomist in charge of agricultural work on the Pacific Coast. Mr. Wright, a graduate of the University of California, was formerly Assistant County Agent and Truck Crop Specialist with the University of California Extension Service.

Nitrogen In Fertilizer Aids Cannery Peas

The use of nitrogenous fertilizers on cannery peas not only results in substantial increases in yields but the fertilized peas remain in a fancy grade for a longer period, according to experiments carried on at the State Experiment Station at Geneva.

Applications of 625 pounds to the acre of an 8–16–8 fertilizer in which the nitrogen came from sulphate of ammonia, ammonium nitrate, or nitrate of soda gave daily increases amounting to several hundred pounds over the daily increase in yield of unfertilized peas, while the peas receiving nitrogen remained in the fancy grade fully a day longer than the unfertilized peas. Ammonium nitrate and sulphate of ammonia proved the best sources of nitrogen. Inoculating the peas with cultures of nitrogen gathering bacteria at double the recommended rate did not meet the nitrogen requirements of the crop.

"As peas approach maturity," says Professor C. B. Sayre, canning crop specialist, "the yield increases but quality declines because the sugar in the peas is converted

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into starch, consequently the peas become harder and less palatable. In harvesting peas for canning or freezing, the objective is to obtain the largest yield commensurate with high quality. Growers, processors, and consumers alike are concerned with the daily rate of change in yield and quality of peas as they reach harvesting stage."

The experiments conducted by Professor Sayre show that well-fertilized peas remain in the fancy grade for a longer period with an increase in yield than do unfertilized peas. Throughout that periodin which the peas were in a desirable condition for canning, the increase in yield and quality due to the fertilizer treatments was more than enough to pay for the cost of the fertilizer. The 1945 growing season was very favorable for peas at Geneva, says Professor Sayre, but the results of the experiments last season confirm results of previous tests along the same line.

Fewer Acres, Richer Grass, More Cows

Pastures treated with phosphate fertilizer will produce more, and more nutritious forage will provide more protein per animal and will carry more animals on fewer acres. All this, according to M. K. Thornton, is in addition to grass of better bone-building quality.

Bone building was all that was once expected of phosphate as a pasture fertilizer, he pointed out. On the basis of data collected by the Texas Agricultural Experiment Station on an experimental plot near Beaumont, Thornton calculated that:

Cows on pastures fertilized with 160 pounds of 20 per cent superphosphate consumed 165 more pounds of protein—the equivalent of 383 pounds of cottonseed meal—in 300 grazing days than did cows on adjacent unfertilized pastures.

The fertilized pastures produced 4,570 pounds of dry forage per acre as compared with 2,062 pounds per unfertilized acre, an increase of 2,508 pounds.

Protein equivalent per fertilized acre was 477 pounds as against 171 pounds per acre in the unfertilized plot.

One and two-tenths acres of the phosphated pasture carried one cow—based on a consumption of 25 pounds of dry forage per day for 300 days—while it took 3.67 unfertilized acres for one cow.

These figures, Thornton said, bear out observations on pastures fertilized with phosphate under farm conditions. Such pastures have consistently shown increased yield and carrying capacity and turned out strong, healthy animals.

Good Profit from Soil Improvement in Ohio

Applications of lime and fertilizer in 1946 will be one of the best investments Ohio farmers can make, in the opinion of rural economists at Ohio State University, who say use of fertilizer and lime will pay a profit and will materially help food production with the same number of acres planted or will maintain the total of food produced if lack of labor reduces acres planted.

The economists explain that prices for lime and fertilizer in March, 1946, were up about 21 per cent from the average price level for those commodities in 1935–39 but wheat

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prices were up 87 per cent and corn prices 69 per cent from their 1935–39 levels. It is apparent that the chance of making money from use of lime and fertilizer is considerably better now than in pre-war years.

Ohio farmers in 1935–39 had to exchange 35 bushels of wheat or 45 bushels of corn to obtain a ton of 2–12–6. A ton of the same fertilizer now can be bought with the money from 20 bushels of wheat or 28 bushels of corn. An increase of two bushels of wheat or about three bushels of corn per acre would pay for applying 200 pounds of 2–12–6.

Ohio experiments and the practical experience of Ohio farmers have proved that fertilizers are much more effective in increasing crop yields if enough lime has been applied to correct soil acidity. Lime alone has caused increased yields for most field crops grown in Ohio, but agronomists urge using both lime and fertilizer.

The rural economists believe that Ohio soils have been considerably depleted in fertility by crop production in the past four years, when alfalfa and clover acreages have been reduced and the acreage of cultivated crops and grains has increased. They say now is a good time to make up some of the overdrafts that have been drawn on the Ohio soil productivity account. Fertilizers and lime help restore the balance.

Superphosphate Production for 1945

Production of superphosphate in normal, concentrated and base goods during 1945 totaled 8,038,519 tons, when figured on the basis of 18 per cent APA. This represents the largest output in the history of the industry. Normal superphosphate accounted for 7,372,-104 tons, concentrated (45 per cent) for 250,960 tons, and base goods for 39,015 tons. The above output was produced in 159 plants, located in 24 states. Georgia with 29 plants led in the number of plants. Maryland, with only seven plants, led in tonnage, producing 21,29,534 tons of normal super.

PRODUCTION OF NORMAL SUPERPHOSPHATE
(In short tons, 18% APA)

State	Number of plants	Production	Stocks on hand end of year
Alabama	14	406,980	50,901
Florida	6	386,757	32,248
Georgia	29	896,808	116,518
Illinois	7	473,400	38,444
Indiana	6	183,600	21,023
Louisiana	5	242,034	26,264
Maryland	7	1,229,534	69,258
Massachusetts	3	107,471	17,716
Mississippi	6	108,051	25,930
New Jersey	4	296,719	18,201
North Carolina	13	410,660	58,007
Ohio	15	576,851	80,388
South Carolina	11	418,407	49,077
Tennessee	9	445,917	63,478
Virginia	9	505,232	75,859
Miscellaneous States*.	15	683,683	64,715
United States, total.	59	7,372,104	808,027

*The number of plants in each of these states is as follows: Arkansas, 2; California, 2; Idaho, 1; Maine, 1; Michigan, 2; Missouri, 2; New York, 2; Pennsylvania, 1; Texas, 2.

SUPERPHOSPHATE PRODUCTION, 1945
(Short Tons)

	Normal 18% APA	Concentrated 45% APA	Base Goods 18% APA
January	626,947	18,103	4,302
February	587,740	18,560	3,869
March	587,467	20,861	3,176
April	576,195	20,632	4,628
May	606,808	20,006	752
June	614,922	22,053	1,019
July	611,388	21,251	2,332
August	638,046	21,617	2,819
September	587,428	23,694	4,477
October	690,120	15,806	3,179
November	651,449	24,893	4,341
December	593,594	23,484	4,121
Total	7,372,104	250,960	39,015

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122 East 42nd ST., NEW YORK CITY

Pioneer Producers of Muriate of Potash in America

See Page 20

THE PLANT FOOD CONTENT OF FERTILIZERS

(Continued from page 9)

tains calcium, sulphur and other elements that are known to be essential in promoting crop growth. It is therefore a mistake to say that superphosphate contains 80 per cent of inert material.

It is possible that some of the components of ordinary superphosphate may be considered as inert and, being present in mixture, may be eliminated without seriously impairing its value as a fertilizer. This has been done within recent years to such an extent as to increase its P_2O_5 content to a maximum of 48 per cent. Any further increase in the plant-food content of superphosphate would not be economical and would be certain to impair its value as a fertilizer.

By proper selection of the higher analysis materials, it is now possible to prepare mixed fertilizers that contain as high as 60 per cent of total plant food. Mixtures of this kind offer certain economic advantages in the way of handling, bagging and shipping costs and good results have been claimed for such mixtures in certain sections of the country. Their use in other sections has resulted in unfavorable crop yields due to a deficiency of one or more of the secondary fertilizer elements.

The same criticism has not been made of mixed fertilizers containing up to 40 per cent of plant food. Numerous tests have shown that mixtures within this range can be readily prepared and contain an ample supply of all the essential plant-food elements.

Although mixtures containing a maximum of 40 per cent of total plant food are now being successfully used in certain sections of the country, there are many reasons why their use is not likely to become general in all parts of the United States. One important reason has to do with the physical properties of many high grade materials and mixtures. Most of the high analysis synthetic materials that are prepared from the air tend to cake or become sticky by absorption of moisture under humid conditions. This can largely be prevented by the addition to the fertilizer of a low analysis, water-insoluble material that does not have the property of absorbing moisture. These low analysis materials, or conditioners as they are called, must necessarily decrease the plant-food content of mixed fertilizers in proportion to the quantity added.

The proportion of a conditioner or of a low analysis material that can be economically used in a mixed fertilizer will vary in different locations depending on the original cost of the material and on transportation charges. The greatest fertilizer consuming area and concentration of fertilizer manufacturing plants is in the South Atlantic States. This area is also the most humid section of the United States and the one in which there is most urgent need for conditioners in fertilizers. It would be expected therefore that the analysis of the average mixed fertilizer sold in this part of the country would be less than that of the average mixture sold in the northern and western sections of the United States. The data in Table I show that this is the case.

TABLE I.

INCREASE IN THE PLANT-FOOD CONTENT OF MIXED FERTILIZERS IN DIFFERENT SECTIONS OF THE UNITED STATES DURING THE 10-YEAR PERIOD, 1934 TO 1943, INCLUSIVE

Group of States	*Average Plant Food Content of Mixed Fertilizers* 1934	1943	Increase during 10-year period
New England	23.5	25.2	7 %
Middle Atlantic	19.1	22.9	20 %
South Atlantic	16.2	18.8	16 %
East North Central	20.7	24.5	18 %
West North Central	19.1	24.8	30 %
South Central	16.5	20.6	25 %
Western	25.2	23.4	−7 %
United States	18.2	21.5	18 %

Table I further shows that during the 10-year period, 1934 to 1943, the plant-food content of the average mixed fertilizer in-

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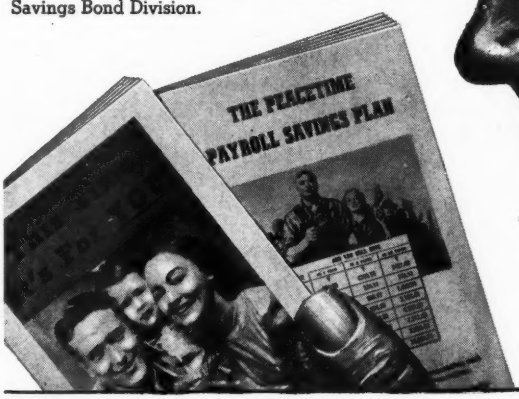
If you have not received these two booklets, or desire additional quantities, communicate with your State Director of the Treasury Department's Savings Bond Division.



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creased 18 per cent for the United States as a whole; that all sections of the country with the exception of the Western States, showed some increase; and that the greatest increase occurred in the West North Central States. Where the total fertilizer consumptionis still relatively low, it is probable that this increase in the plant-food content of fertilizers will continue for some time but at a slower rate as the average approaches the maximum that is practical for mixed fertilizers. The use of a limited quantity of low analysis materials in mixed fertilizers not only improves the mechanical condition of most mixtures but also provides a market for certain materials that are not adapted for use in other industries.

MORE EVIDENCE THAT SODIUM IS A PLANT FOOD

(Continued from page 14)

gave excellent results. But farmers often find out what constitutes good farming practice long before the agricultural experiment stations. They operate on a "cut-and-try" basis in deciding on field practice. Since there are so many more farmers than there are experiment station workers, the farmers are the first to "stumble" onto the answers. True, they don't always know the "why" of things, but they find out the "what, when, and how." So farmers have long been top-dressing and side-dressing their crops with nitrate of soda and getting better results than soil and plant scientists thought they were entitled to.

Until recently, however, no scientist was prepared to make the claim that sodium itself was an essential element to any plant. On the contrary, highly capable plant physiologists had found no evidence of any need for sodium on the part of any plants with which they had worked. Accordingly, the conclusion had been reached that if sodium had any function, it was that of liberating potassium from the soil complex or of taking its place in some of the more minor roles of potassium in the plant.

Effect on Cotton Yields

In the latest report on this subject, that of Holt and Volk, one finds further evidence, however, that sodium has value in itself. Seven crops, including cotton, oats, sugar beets, wheat, vetch, Austrian peas, and turnips, were grown in sand cultures in their experiments. Potash was applied in amounts varying from none to 144 pounds per acre, in conjunction with all the other known essential elements. When sodium equivalent to 1,800 pounds of nitrate of soda per acre was applied, the increase in yield for the seven crops averaged from 52 per cent for the no-potash treatments to 10 per cent for the highest potash treatments. The most marked increase when no potash was applied was obtained with cotton. When plenty of potash was added, the greatest increases were obtained with oats and sugar beets.

In 47 field trials comparing various carriers of nitrogen on cotton being grown on sandy soils of low productivity, the addition of sodium increased the yield of seed cotton by 98 to 213 pounds per acre. From these studies, the conclusion was reached that 'beneficial results may be expected from the application of sodium to soils either low in available potassium or sodium, or both." It appears, therefore, that sodium should be included among the essential plant food elements.

Good Methods Pay with Kentucky Tobacco

One of the best tobacco crops grown in Lee County, Kentucky, last year was that of W. O. Mays of the Cressmont community, one and nine-tenths acres of No. 16 Burley producing 4,272 pounds which sold for more than $1,900.

Mays made careful preparation for his crop according to Farm Agent T. H. Jones. The plant beds were sprayed twice with bluestone-lime solution, and the field was prepared by plowing under a cover crop of vetch and wheat to which phosphate had been applied. Then Mr. Mays worked 35 loads of barn manure into the soil, and used 3,200 pounds of 6–8–6 fertilizer, half of which was broadcast and the other half drilled when the tobacco was set.

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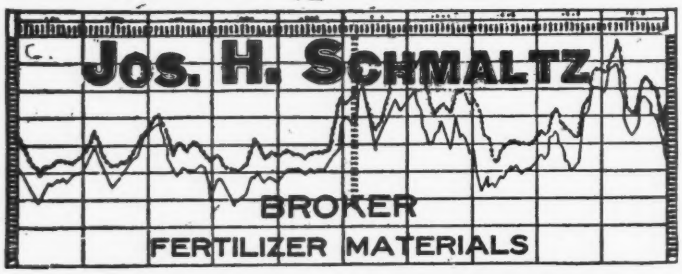

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